Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

9751707663

COMBINED SCIENCE **0653/62**

Paper 6 Alternative to Practical **February/March 2021**

1 hour

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS
- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

INFORMATION
- The total mark for this paper is 40.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **16** pages. Any blank pages are indicated.

DC (CJ/JG) 208154/2

1 A student investigates the rate of respiration in yeast cells. Yeast is a single-celled organism similar to plant and animal cells.

The student is provided with a yeast suspension and some yeast suspension that has been boiled.

As yeast cells respire they produce carbon dioxide gas.

(a) Describe the observation that shows that a gas is made in a liquid.

....

.... [1]

(b) The student does the following procedure:

Step 1 puts 1 cm^3 **distilled water** into a test-tube labelled **A**

Step 2 fills test-tube **A** to the top with yeast suspension

Step 3 puts 1 cm^3 **5% glucose** solution into a test-tube labelled **B**

Step 4 fills test-tube **B** to the top with yeast suspension

Step 5 puts 1 cm^3 **5% glucose** solution into a test-tube labelled **C**

Step 6 fills test-tube **C** to the top with **boiled** yeast suspension

Fig. 1.1 shows the filled test-tubes.

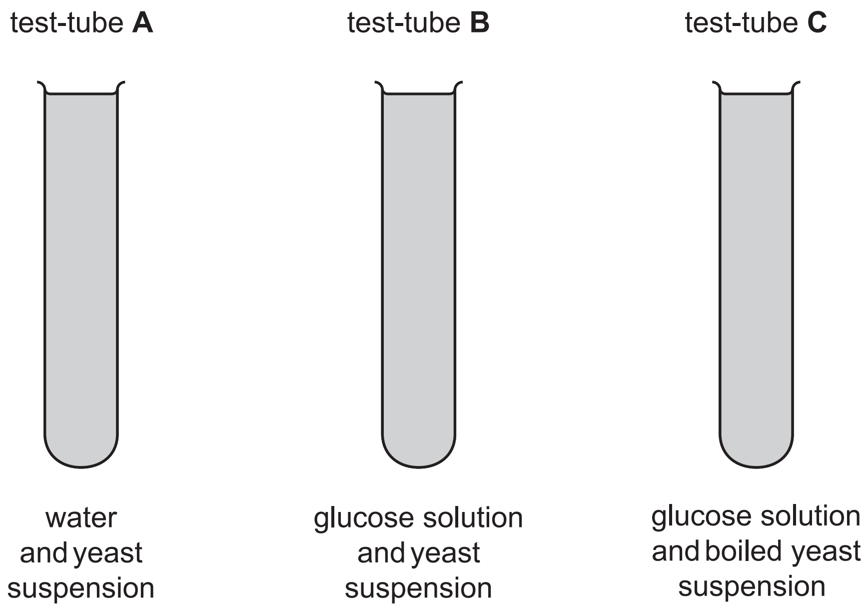
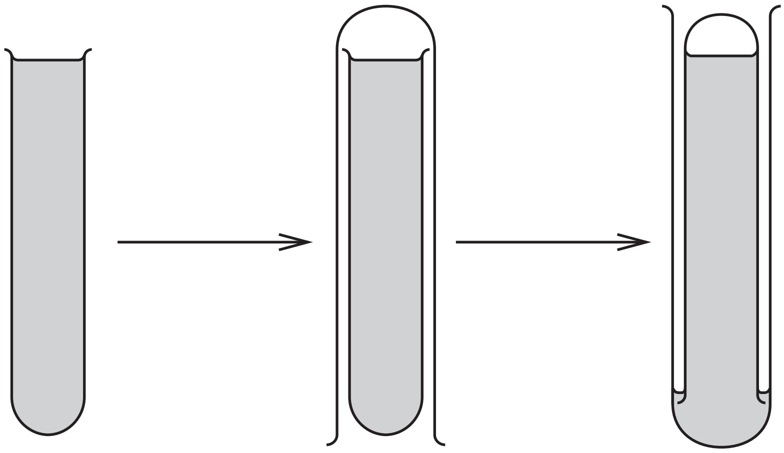


Fig. 1.1

Step 7 places a large test-tube (boiling tube) over the top of each of the test-tubes **A**, **B** and **C**

Step 8 turns the test-tubes upside down as shown in Fig. 1.2



filled test-tube

large test-tube placed over the top of filled test-tube

both test-tubes quickly turned upside down

Fig. 1.2

Step 9 places all of the test-tubes into a water-bath at 40 °C

Step 10 leaves the test-tubes in the water-bath for 5 minutes.

If gas is made in the small test-tube, the liquid is pushed out into the large test-tube.

After 5 minutes the student measures the height of the liquid in each large test-tube (boiling tube), as shown in Fig. 1.3.

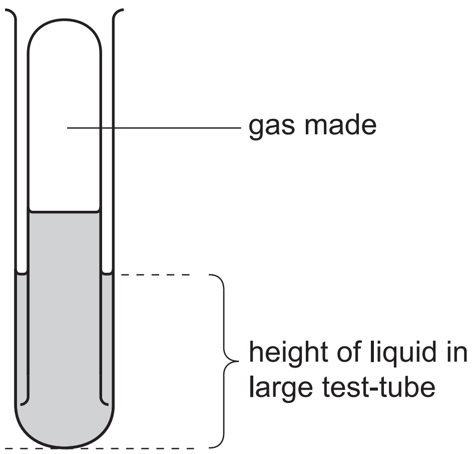


Fig. 1.3

The results are recorded in Table 1.1.

Table 1.1

test-tube	height of liquid / mm
A	18
B	
C	5

(i) Fig. 1.4 shows the height of liquid in the large test-tube around test-tube **B**.

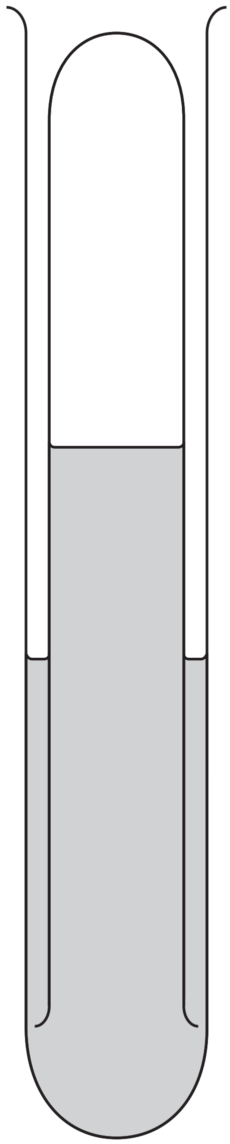


Fig. 1.4

Measure this height to the nearest mm and record it in Table 1.1. [1]

(ii) Test-tube **B** contains glucose.

Test-tube **A** contains no glucose.

Use this information to explain the difference in the results for test-tube **B** and test-tube **A**.

....

.... [1]

(iii) Test-tube **C** is used as a type of control.

Explain the purpose of this control.

....

.... [1]

(iv) Explain why it is difficult to get an accurate value for the height of a liquid in a test-tube.

....

.... [1]

(v) Describe a test to find out if the gas made is carbon dioxide. Include the observation for a positive result.

test ....

....

observation ....
[1]

(vi) State **one** variable that is kept constant in this investigation.

....

.... [1]

(c) The teacher does a similar experiment at 40 °C to investigate the effect of different concentrations of glucose on the yeast suspension. The teacher measures the volume of gas collected after 5 minutes.

The results are shown in Table 1.2.

Table 1.2

percentage concentration of glucose solution	volume of gas collected after 5 minutes / cm^3
6	3
7	8
8	7
9	18
10	23
11	23

(i) The result for 8% glucose solution is anomalous.

Suggest what might have caused this anomalous result.

....

.... [1]

(ii) Predict the expected volume of gas for the 8% glucose solution.

....cm^3 [1]

(iii) Describe the relationship between the percentage concentration of glucose solution and the volume of gas made.

....

....

....

.... [2]

(iv) Suggest a piece of apparatus suitable for collecting the gas and measuring its volume.

.... [1]

(v) The teacher repeats their investigation at 20 °C instead of 40 °C. Suggest what effect, if any, a lower temperature has on the results.

....

.... [1]

[Total: 13]

2 A student prepares a sample of the insoluble salt barium sulfate by reacting aqueous copper(II) sulfate with aqueous barium nitrate.

(a) Procedure

The student:

- measures 15 cm^3 of aqueous copper(II) sulfate and pours it into a beaker
- measures 7.5 cm^3 of aqueous barium nitrate and pours it into the beaker
- stirs the reaction mixture
- filters the reaction mixture and collects the blue filtrate in a conical flask.

(i) Explain why a 10 cm^3 measuring cylinder is used to measure the aqueous barium nitrate rather than a 25 cm^3 measuring cylinder.

....

.... [1]

(ii) State one observation of the **filtrate** in the conical flask that shows it contains copper(II) ions.

.... [1]

(b) The residue of barium sulfate on the filter paper is impure.

(i) The impure residue contains some soluble copper(II) compounds.

Describe how the student purifies the barium sulfate by removing the soluble copper(II) compounds from the residue.

....

.... [1]

(ii) State the colour of the purified barium sulfate precipitate.

.... [1]

(c) The student tests two samples of the filtrate.

Here is a page from the student's notebook.

With four drops of sodium hydroxide solution = blue precipitate
With a little aqueous ammonia the filtrate gives a blue precipitate

There is a blue precipitate when lots of sodium hydroxide solution is added
Gives a dark blue solution when lots of aqueous ammonia is added

Present these results in a results table.

Include the headings for the table, the tests used and the observations.

[3]

[Total: 7]

3 Calcium hydroxide is a white solid that is added to acidic soils to increase their pH.

Calcium hydroxide neutralises acids such as dilute nitric acid to make a salt and water.

Plan an investigation to find out how the pH of dilute nitric acid changes as calcium hydroxide is added to the acid.

You are provided with:
- calcium hydroxide powder
- dilute nitric acid
- Universal Indicator solution.

You may use any common laboratory apparatus in your plan.

In your plan, include:

- the apparatus needed
- a brief description of the method and explain any safety precautions you should take
- what you would measure
- which variables you would keep constant
- how you would process your results to draw a conclusion.

You may include a labelled diagram if you wish.

You may include a table that can be used to record the results if you wish.

....

....

....

....

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....

....

....

....

.... [7]

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4 A student investigates the rate at which hot water cools.

(a) Procedure

The student:

- ¾ fills a beaker with water at room temperature
- records in Table 4.1 the initial temperature of the water in the beaker
- half-fills a test-tube with hot water
- records in Table 4.1 the initial temperature of the hot water in the test-tube
- secures the test-tube in the beaker so that the hot water level is below the level of the water in the beaker
- records in Table 4.1 the temperature of the water in the beaker and the temperature of the water in the test-tube every 30 s for 180 s.

(i) Fig. 4.1 shows an incomplete diagram of the student's experiment.

Complete Fig. 4.1 by:

- marking the hot water level in the test-tube
- adding a thermometer to measure the temperature of the hot water.

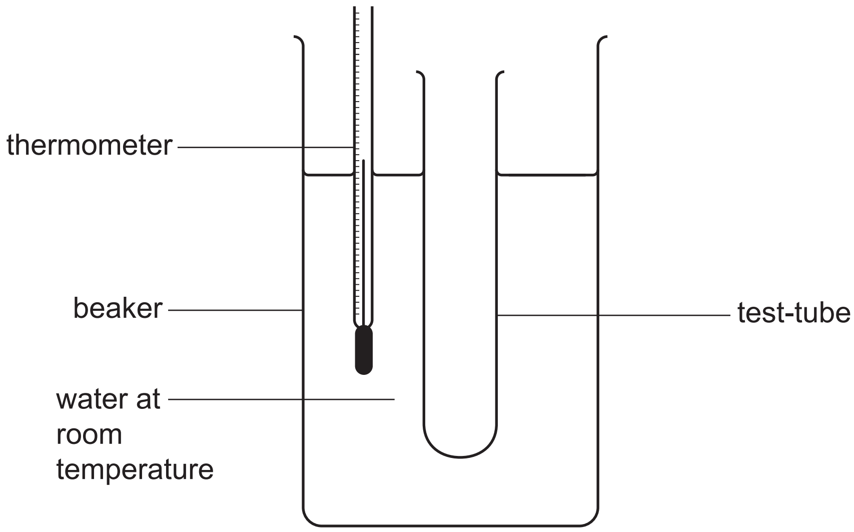


Fig. 4.1

[2]

(ii) Fig. 4.2 shows the thermometer readings at 180 s.
Record these temperatures in Table 4.1.

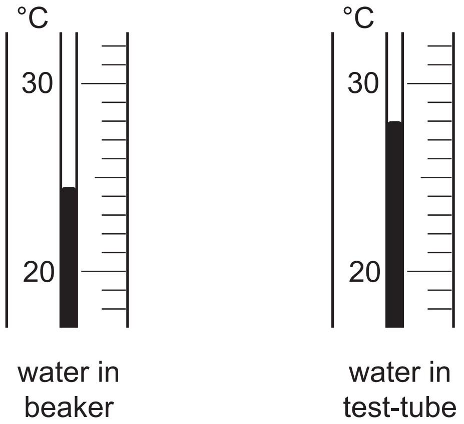


Fig. 4.2

Table 4.1

time / s	temperature of water in	
	beaker / °C	test-tube / °C
0	23.5	76.0
30	23.5	57.0
60	23.5	45.0
90	23.5	38.0
120	24.0	33.5
150	24.0	30.0
180		

[3]

(iii) Describe one practical technique the student uses to ensure that the temperature of the water in the beaker is measured accurately.

....

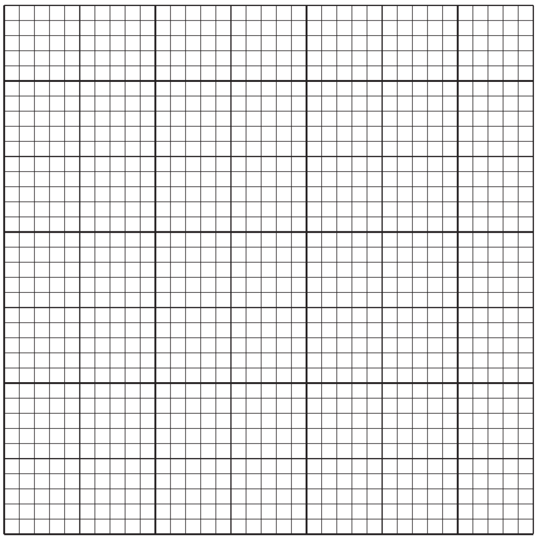
.... [1]

(iv) Suggest why the temperature of the water in the beaker changes during the experiment.

....

.... [1]

(b) **(i)** Plot a graph of the temperature of the hot water in the **test-tube** (vertical axis) against time using the results in Table 4.1. Do **not** start the temperature scale at 0 °C.



[3]

(ii) Draw the best-fit curve. [1]

(c) **(i)** Calculate the rate of cooling of the hot water in the **test-tube** during the first 30 s. Use the equation shown.

$$\text{rate of cooling during first 30 s} = \frac{\text{temperature at 0 s} - \text{temperature at 30 s}}{30}$$

Give your answer to **two** significant figures.

rate of cooling = ... °C / s [1]

(ii) Describe how the rate of cooling of the hot water in the test-tube changes during the 180 s.

....

.... [1]

[Total: 13]

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